

University Foodservice Employees' Food Safety Knowledge, Attitudes, Practices, and Training

Shu-Ying Lin, MS
Former Master's student
Iowa State University

Jeannie Sneed, PhD, RD, SFNS, CFSP*
Iowa State University
Hotel, Restaurant, and Institution Management

University Foodservice Employees' Food Safety Knowledge, Attitudes, Practices, and Training

ABSTRACT

Foodservice workers play a major role in preventing outbreaks of foodborne illness and in meeting the goal of serving safe food. The purpose of this study was to assess foodservice employees' knowledge, attitudes, practices, and training regarding food safety at one midwestern university. Comparisons were made between student and full-time employees. Full-time employees had higher ($p \leq 0.001$) mean total scores for food safety knowledge, attitudes, practices, and training than student employees. Emphasis on food safety training for student employees is needed to ensure these employees have appropriate food safety knowledge and attitudes and to ensure that food safety practices are followed.

INTRODUCTION

Food safety is a critical issue facing the foodservice industry. An understanding of food safety procedures and potential factors that cause foodborne illness is very important for all food handlers. Cohen, Reichel, and Schwartz (2001) stated “only knowledgeable, motivated, and skilled employees who are trained to follow the proper procedures together with management that effectively monitors employees’ performances can ensure food safety” (pp. 6-7). Foodservice workers play a major role in prevention and control of outbreaks of foodborne illness.

University foodservice managers typically employ a large number of part-time employees to provide flexibility in staffing (Neumann, Stevens, & Graham, 2001). It is not uncommon that university foodservice managers hire many part-time and international student employees with no foodservice experience. In addition, many student employees work in university foodservice for only one or two semesters and leave for employment in other fields (Fiihr, 2001). As a result, student employees may have less awareness of and concern about principles of food safety than full-time employees. It is very important for managers to educate both student and full-time employees about food safety, train them to use appropriate food handling procedures, and monitor their performance.

Several studies have been conducted to assess college students’ and foodservice employees’ food safety knowledge, attitudes, practices, and training. Unklesbay, Sneed, and Toma (1998) studied college students’ attitudes, practices, and knowledge of food safety. Results showed that students in dietetics, food science, nutrition, and health programs had higher attitude scores compared to students in other majors. Females, upperclassmen, graduate students, and those who took at least one course related to food safety had higher mean scores for

food safety knowledge, attitudes, and practices than males, freshmen and sophomores, and those who had not taken a food safety course. These researchers suggested that all educators in food-related disciplines should educate college students about the importance of consumer food handling behaviors and the fact that consumers share responsibility for food safety.

Wie and Strohbehn (1997) studied the impact of a sanitation and food safety course on attitudes and knowledge of hospitality students. These researchers analyzed data from 68 students required to take a sanitation and safety course in the hospitality major. Researchers compared students' knowledge and attitudes toward sanitation and food safety before and after completion of the course. Results of this study showed students' knowledge and attitudes improved after completion of the course. They concluded that offering a foodservice sanitation and safety training course, coupled with continuing education, was very important for increasing knowledge.

Cushman, Shanklin, and Niehoff (2001) conducted a study to measure personal hygiene practices of part-time student employees in three on-site foodservice facilities in one university. Findings of this study showed that female student employees had higher mean hygiene practice scores than male student employees. This study also showed that the length of employment with the facility or organization influenced personal hygiene practices negatively. These researchers concluded that the majority of part-time student employees performed personal hygiene practices properly.

Hsu and Huang (1995) studied sanitation knowledge, attitudes, and behaviors of 178 university foodservice non-managerial workers in nine universities. Results indicated that foodservice workers were most knowledgeable about dishwashing procedures (91.9%) and mold-related food poisoning issues (88.6%). Respondents were least knowledgeable about

microorganisms (68.2%). Results also showed that respondents had positive attitudes and behaviors. Variables influencing sanitation knowledge, attitudes, and behaviors were educational level, age, gender, work experience, and amount of employee training. These researchers concluded that design of future training programs should allow employees to apply the new knowledge they learn in real life situations and work environments. It is recommended that managers of university foodservice conduct food safety training on a routine basis for both new employees and current employees and update new food safety knowledge and materials when those become available. Repeated training could improve employees' food safety knowledge, increase employees' positive attitudes toward food safety, and influence their food safety behaviors.

Henroid and Sneed (2004) evaluated food handling practices, presence of prerequisite food safety programs, and employees' food safety knowledge and attitudes in 40 Iowa school foodservice operations to determine readiness for implementing hazard analysis critical control point (HACCP) programs in school foodservice operations. These researchers found that employees had high food safety knowledge (15.9 ± 2.4 out of 20 points) and overall positive food safety attitudes (ranging from 4.2 to 4.8 out of 5 points). However, observations of food handling practices indicated that proper food handling practices sometimes were not followed. Areas identified for improvement included inadequate taking and recording of food temperatures, infrequent and improper handwashing, inappropriate food cooling and thawing, and inadequate checking and recording of sanitizer concentrations.

In a study of food safety practices and readiness to implement HACCP programs in assisted-living facilities in Iowa, Sneed, Strohbahn and Gilmore (2004) identified a number of food safety practice concerns. These researchers found that employees were least

knowledgeable about food cooling and thawing practices, sanitizer concentration, and minimum end-point cooking temperatures. Researchers observed that handwashing sometimes was inappropriate, effective hair restraints often were not used, food temperature monitoring and recording were infrequent, and sanitizer concentration was not checked regularly. Researchers concluded that employees in assisted-living foodservice had sufficient food safety knowledge and positive attitudes toward food safety, but food safety practices still needed to improve, which was consistent with findings in the Henroid and Sneed study (2004).

Previous research studies have focused on full-time employees' food safety knowledge, attitudes, and practices in restaurants, temporary food facilities, and institutional foodservices with little research has focused on student employees. The purpose of this study was to assess foodservice employees' food safety knowledge, attitudes, practices, and training at one Midwestern university and determine if there were differences in these variables between student and full-time employees.

METHODOLOGY

Subjects

A convenience sample of all student (N=547) and full-time (N=91) employees working in six residence dining centers at the university in Spring 2003 was used for the study. The research protocol and questionnaires were approved by the university Human Subjects Research Office prior to data collection. Approval of the project also was obtained from the director and assistant director of Dining Services.

Questionnaire Design

A 5-part questionnaire was developed to identify student and full-time employees' food safety knowledge, attitudes, practices, and the training received from Dining Services related to

food safety. Part one was designed to measure employees' knowledge related to food safety and included 10 multiple-choice questions. These questions were related to general food safety knowledge such as personal hygiene, definition of foodborne illness, time and temperature control, cross contamination, glove use, and sanitizing. The Cronbach alpha reliability coefficient for the 10 knowledge items was 0.41. Part two of the questionnaire included 12 questions to determine employees' attitudes toward food safety. A 5-point Likert-type rating scale, ranging from one (1) "strongly disagree" to five (5) "strongly agree", was used. The Cronbach alpha reliability coefficient for the 12 attitude items was 0.83. Part three of the questionnaire consisted of 14 questions measuring employees' self-reported on-the-job food safety practices. A 3-point rating scale was used to indicate frequency of food safety practices: always; sometimes; and never. An option of "not applicable" was provided for each practice question. The Cronbach alpha reliability coefficient for the practice items was 0.72. Part four of the questionnaire was developed to identify food safety topics taught to employees during orientation or on-the-job training. This part consisted of 16 questions, and respondents answered these statements by checking yes or no. The Cronbach alpha reliability coefficient for the 16 training items was 0.87. The final section collected demographic characteristics of student and full-time employees.

Pilot Test

The questionnaire was pre-tested by 20 undergraduate students who work in foodservice but not ISU Dining Services. Three graduate students enrolled in the Research in Foodservice Operations course also were asked to complete the questionnaire and to identify concerns and suggestions. All suggestions were considered and used to revise the questionnaire before data collection.

Data Collection

The questionnaire and a cover letter were distributed to student employees before or after they had clocked out for a shift and placed under the time clock for student employees who were willing to participate in this study but were unable to be present at the time of distribution. The questionnaire and a cover letter were placed in full-time employees' mailboxes at the work place. Employees placed completed questionnaires in designated sealed boxes in the dining hall office.

Data Analyses

SPSS version 11.0 for Windows was used for all data analyses. Descriptive statistics including frequencies, means, and standard deviations were calculated for all variables as appropriate. Analysis of variance (ANOVA) was used to examine differences in food safety knowledge, attitudes, practices, and training between student and full-time employees. ANOVA and correlations assessed the relationship between student and full-time employees' demographic characteristics and the mean total scores for food safety knowledge, attitudes, and practices. Multiple linear regression was used to test relationships among employees' food safety knowledge, attitudes, practices, training, and demographic variables. A probability of equal to or less than 0.05 was considered significant.

RESULTS AND DISCUSSION

Demographic Information

Student employees returned 221 questionnaires for a 40% response rate. Thirty-eight questionnaires were completed by full-time employees for a 42% response rate. Demographic characteristics of student and full-time employees are presented in Table 1.

Table 1. Demographic Characteristics of Student (N = 221) and Full-Time Employees (N = 38)

Characteristic	<u>Student</u> n (%)		<u>Full-Time</u> n (%)
Age (years)		Age (years)	
18-19	105 (47.5%)	<30	9 (23.7%)
20-21	81 (36.7%)	31-50	15 (39.5%)
22-23	27 (12.2%)	51-65	12 (31.6%)
24-28	6 (2.7%)	>65	1 (2.6%)
Gender		Gender	
Female	135 (61.1%)	Female	34 (89.5%)
Male	86 (38.9%)	Male	4 (10.5%)
Country		Education level	
United States	207 (93.7%)	High school	15 (39.5%)
International	14 (6.3%)	Some college	16 (42.1%)
College status		Bachelor's degree	1 (2.6%)
Freshman	85 (38.5%)	Years worked in ISU Dining	
Sophomore	65 (29.4%)	≤5	18 (47.4%)
Junior	39 (17.6%)	6-15	12 (31.6%)
Senior	32 (14.5%)	16-25	6 (15.8%)
College major		≤26	1 (2.6%)
Liberal arts and sciences	71 (32.1%)	Number of food safety training sessions received	
Engineering	38 (17.2%)	0	0 (0%)
Business	32 (14.5%)	1-2	17 (44.7%)
Education	17 (7.7%)	3-4	5 (13.2%)
Design	15 (6.8%)	5-6	2 (5.3%)
Family and consumer Sciences	15 (6.8%)	>6	8 (21.1%)
Agriculture	9 (4.1%)	Food safety certification	
Undecided	6 (2.7%)	Yes	27 (71.1%)
Food science and human nutrition	5 (2.3%)	No	5 (13.2%)
Hotel, restaurant, and institution management	5 (2.3%)		

Table 1. (Continued)

Characteristic	<u>Student</u> n (%)
Position	
Student employee	188 (85.1%)
Student supervisor/leader	33 (14.9%)
Hours worked	
<10 hrs/wk	11 (5.0%)
10-15 hrs/wk	144 (65.2%)
16-20 hrs/wk	61 (27.6%)
Semesters employed by ISU Dining	
1-2	144 (65.2%)
3-4	38 (17.2%)
5-6	24 (10.9%)
>6	13 (5.9%)
Number of on-the-job food safety training received	
0	30 (13.6%)
1-2	117 (52.9%)
3-4	40 (18.1%)
5-6	8 (3.6%)
>6	1 (0.5%)

Note. Percentages may not total 100% due to non-response to a question.

Knowledge Related to Food Safety

Food safety knowledge questions were grouped into six categories: personal hygiene, foodborne illnesses, time and temperature control, cross contamination, glove use, and sanitizing. Full-time employees had higher ($p \leq 0.001$) mean total scores for food safety knowledge than student employees. The frequency of correct responses for each food safety knowledge item for student and full-time employees is presented in Table 2.

Both student and full-time employees had a high number of correct responses when asked about the definition of foodborne illness (95.9% and 100%), cross contamination (94.1% and 97.4%), glove use (95.5% and 100%), and one of the questions about personal hygiene: “After washing their hands, employees should avoid touching their hair” (96.4% and 89.5%).

Approximately half (52.9%) of the student and one-third (29.9%) of full-time employees selected glove use over frequent handwashing when asked about the most important rule for personal hygiene; student employees had a lower correct score ($p \leq 0.001$) than full-time employees on this question. When asked about the temperature danger zone for potentially hazardous foods, there was a difference ($p \leq 0.001$) between student and full-time employees. About half (48.4%) of student employees answered the temperature danger zone question correctly while 78.9% of full-time employees answered it correctly. Full-time employees had higher ($p \leq 0.01$) scores than student employees on time and temperature control questions: “The most important factors to control the growth of bacteria are time and temperature” (94.7% and 70.1%, respectively), and “When holding hot foods for service, it is required that internal food temperatures be taken at least every two hours” (84.2% and 51.6%, respectively). A high percentage of full-time employees had completed a ServSafe® course and were certified in food safety.

Only 39.4% of student employees correctly answered the question about an appropriate method for thawing “Under running water that is 70°F or less is acceptable method for thawing frozen food”, which was lower ($p \leq 0.001$) than the percent of full-time employees who answered the question correctly. Less than half of student and full-time employees (43.4% and 42.1%, respectively) responded to the sanitizing question correctly. These results were consistent with the results of Sneed, Strohbehn, and Gilmore (2004) and Henroid and Sneed (2004). These researchers found that foodservice employees were least knowledgeable about sanitizer concentration and cooling and thawing practices. However, in this study some Dining Centers used high temperature dishwashing machines for washing, cleaning, and sanitizing items, therefore, employees may not be required to know about the concentration of sanitizing solutions.

Table 2. Comparison of the Number of Correct Responses for Each Food Safety Knowledge Item for Student (N = 221) and Full-Time (N = 38) Employees

Knowledge Items	Student		Full-Time		Sig.
	n	%	n	%	
<u>Personal hygiene</u>					
After washing their hands, employees should avoid touching their hair.	213	96.4%	34	89.5%	0.153
The most important rule of foodservice personal hygiene is that employees must wash their hands often.	104	47.1%	27	71.1%	0.001***
<u>Definition of foodborne illness</u>					
Foodborne illnesses are diseases that are carried or transmitted to people by food.	212	95.9%	38	100%	0.266

Table 2. (Continued)

Knowledge Items	Student		Full-Time		Sig.
	n	%	n	%	
<u>Time and temperature control</u>	155	70.1%	36	94.7%	0.002**
The most important factors to control the growth of bacteria are temperature and time.					
When holding hot foods for service, it is required that internal food temperatures be taken at least every two hours.	114	51.6%	32	84.2%	0.000***
The temperature danger zone for potentially hazardous foods is 41° to 140°F.	107	48.4%	30	78.9%	0.000***
Under running water that is 70°F or less is an acceptable method for thawing frozen food.	87	39.4%	33	86.8%	0.000***
<u>Cross contamination</u>					
Cross contamination is the transfer of harmful substances or micro-organisms to food from food or from a nonfood-contact surface, such as equipment, utensils, or hands.	208	94.1%	37	97.4%	0.47
Rita wore disposable gloves while she formed raw ground beef into patties. After she was finished, she wore the same gloves to slice smoked turkey breast for sandwich. What mistake did Rita make? She failed to change her gloves and wash her hands after handling raw meat and before handling a ready-to-eat food item	211	95.5%	38	100%	0.21
<u>Sanitizing</u>					
When iodine solutions (such as Mikrokylene) are used for sanitizing, the item must be immersed in the solution for 30 seconds.	96	43.4%	16	42.1%	0.85

** $p \leq 0.01$

*** $p \leq 0.001$

Attitudes and Practices Related to Food Safety

Full-time employees had higher ($p \leq 0.001$) mean total scores for food safety attitudes and practices than student employees. Table 3 shows the means and standard deviations for responses to attitudinal statements for student and full-time employees. For the 12 attitudinal statements, there were 11 statements for which student employees had lower scores ($p \leq 0.05$) than full-time employees. Responses to one statement, “I believe that good employee hygiene can prevent foodborne illness” was the same for both groups. Both student and full-time employees were neutral that food safety knowledge would make them more confident about their work.

Full-time employees had higher scores than student employees on 8 of 14 self-reported practice statements ($p \leq 0.05$) (Table 4). Both student and full-time employees had the lowest frequency of practice on checking concentrations of sanitizing solutions (2.1 and 2.5, respectively). This finding was similar to results of studies by Sneed, Strohbahn, and Gilmore (2004) and Henroid and Sneed (2004). These researchers observed sanitizer concentrations were not checked and recorded regularly by employees in assisted-living facilities and school foodservice operations. However, student and full-time employees in some Dining Centers may not be required to check sanitizer concentrations due to using high temperature dishwashing machines in these facilities.

Table 3. Comparison of Mean Food Safety Attitude Scores of Student (N = 221) and Full-Time (N = 38) Employees

Attitude Items	Student		Full-Time		F	Sig.
	Mean ^a	SD	Mean ^a	SD		
I think sanitation is an important part of my job responsibilities.	4.6	0.7	4.8	0.4	5.6	0.019*
I believe that good employee hygiene can prevent foodborne illness.	4.4	0.7	4.6	0.6	1.8	0.187
I think that it is the responsibility of all food handlers to ensure that food is safe to serve.	4.4	0.6	4.8	0.4	16.5	0.000***
I am willing to change my food handling behaviors when I know they are incorrect.	4.3	0.7	4.7	0.5	10.4	0.001***
I am willing to obtain more food safety knowledge.	4.0	0.7	4.6	0.6	20.7	0.000***
It is more important to have tasty food rather than safe food. ^b	4.0	0.9	4.7	0.6	22.7	0.000***
I select a place to eat based on its reputation for good sanitation and cleanliness.	3.9	0.8	4.4	0.6	16.3	0.000***
I think that managers should educate employees on personal hygiene and sanitation regularly.	3.9	0.9	4.3	0.7	10.4	0.001***
I think that only full-time employees should receive food safety training. ^b	3.7	1.1	4.5	0.7	19.6	0.000***
I believe that food safety knowledge not only benefits my work but also my personal life.	3.7	0.9	4.4	0.7	21.6	0.000***
I am willing to attend a food safety training course.	3.5	1.0	4.4	0.8	26.3	0.000***
I believe that food safety knowledge would make me more confident about my work.	3.5	0.9	4.2	0.7	20.8	0.000***

^a The scale for item scores ranged from strongly disagree (1) to strongly agree (5).

^b Item was reverse scored.

* $p \leq 0.05$

*** $p \leq 0.001$

Table 4. Comparison of Mean Food Safety Practice Scores of Student (N = 221) and Full-Time (N = 38) Employees

Practice Items	Student		Full-Time		F	Sig.
	Mean ^a	SD	Mean ^a	SD		
I use gloves or utensils to handle food that is ready-to-eat.	2.9	0.4	3.0	0.2	0.3	0.559
I use a separate clean utensil for each food item.	2.8	0.6	3.0	0.2	4.0	0.047*
I wash my hands vigorously with soap and water before working with food.	2.8	0.5	3.0	0.2	6.1	0.014*
I wash raw produce before using it.	2.8	0.5	2.9	0.4	1.1	0.302
I store chemicals in a non-food storage room.	2.8	0.5	2.8	0.6	0.0	0.877
I store raw food items in an area separate from cooked food.	2.8	0.4	2.9	0.2	2.7	0.106
I wear a clean uniform, when I work in foodservice.	2.7	0.5	3.0	0.0	12.0	0.001***
I wear a hair restraint (cap or hairnet), when I work in foodservice.	2.6	0.5	3.0	0.2	14.9	0.000***
I wash my hands and change into a new pair of gloves after touching anything that may contaminate my hands, when I prepare or serve food.	2.6	0.7	3.0	0.2	8.8	0.003**
I drink or eat food while I am serving or preparing food. ^b	2.5	0.6	2.7	0.5	0.1	0.829
I clean and sanitize work surfaces after each task.	2.5	0.7	2.7	0.5	1.6	0.204
When I am in doubt about the safety of a previously cooked food, I report it to the supervisor.	2.2	1.0	2.9	0.3	15.0	0.000***
I pay attention to expiration dates on foods and do not use foods that have passed the expiration date.	2.2	1.2	2.9	0.3	13.2	0.000***
I check concentrations of sanitizing solutions used for sanitizing work surfaces or items washed in the pot and pan sink.	2.1	0.8	2.5	0.6	5.7	0.018*

^a The scale for responses was never (1), sometimes (2), and always (3).

^b Item was reverse scored.

* $p \leq 0.05$

** $p \leq 0.01$

*** $p \leq 0.00$

Training Components Related to Food Safety

Student and full-time employees were asked to indicate what food safety components had been included in training that they have received while employed at Dining Services. Full-time employees had higher ($p \leq 0.001$) mean total scores for food safety training than student employees. Full-time employees reported more training on 11 of 16 food safety topics ($p \leq 0.05$) than student employees. All full-time employees reported that they had received the food safety component “Preventing cross contamination”; however, only 61% of student employees indicated that they have received it. The majority (92.1%) of full-time employees also reported that they had received information about “Temperature danger zone where microorganisms can grow rapidly”, but only about half (52.1%) of student employees reported they had received it.

Impact of Employees’ Demographic Characteristics on Food Safety Knowledge, Attitudes, and Practices

As student employees’ age increased, food safety attitude and practice scores increased ($r = .168$; $P < .013$ and $r = .152$; $P < .025$). When hours worked increased, practice scores increased ($r = .136$; $P < .046$). Also, as semesters employed by Dining Services increased, knowledge and practice scores increased ($r = .163$; $P < .016$ and $r = .154$; $P < .022$). In contrast, Cushman, Shanklin, and Niehoff (2001) found a negative correlation between personal hygiene practices and length of employment in the facility of the organization.

Significant differences were found between students who worked as regular student employees and those who worked as student supervisors or leaders. Results showed student supervisors or leaders had higher ($p \leq 0.05$) attitude and practice scores than did regular students. Student employees’ study area, gender, country, and college status did not affect food safety knowledge, attitudes, and practices.

Full-time employees' food safety knowledge and attitudes were related ($p \leq 0.05$) only to food safety certification. Full-time employees with food safety certification had higher knowledge and attitude scores than full-time employees without food safety certification. Hsu and Huang (1995) also reported that university foodservice employees who attended sanitation training programs had more positive sanitation behaviors. Sneed, Strohbehn, and Gilmore (2004) and Henroid and Sneed (2004) found that foodservice employees with food safety certification had higher knowledge than those employees who were not certified.

Factors Impacting Food Safety Practices

Four multiple linear regression models were used to test relationships among student employees' food safety knowledge, attitudes, practices, training, and demographic variables. The first model included student employees' food safety knowledge, attitude, and training scores as independent variables and food safety practices score as the dependent variable. The model was significant ($F = 29.68$, $p = 0.000$), and attitudes ($\beta = 0.40$, $p = 0.000$) and training ($\beta = 0.30$, $p = 0.000$) both had an independent influence on practices. The percentage of explained variance (R^2) for the model was 0.29.

The second model included student employees' food safety knowledge, attitudes, training scores, and four demographic variables: age, hours of worked in Dining Services per week, semesters employed by Dining Services, and position as independent variables and student employees' food safety practices score as the dependent variable. These four demographic variables were the only significant demographic variables identified using ANOVA comparison or correlation. The model was significant ($F = 13.08$, $p = 0.000$), and attitudes ($\beta = 0.39$, $p = 0.000$) and training ($\beta = 0.30$, $p = 0.000$) both had an independent influence on practice scores. However, no demographic variables were significant predictors for food safety practice score.

The percentage of explained variance (R^2) for this model was 0.31, which was little improvement over the model without the demographic variables.

The third model included student employees' food safety attitude, practice, and training scores, and four demographic variables as independent variables and student employees' food safety knowledge as the dependent variable. This model was significant ($F = 2.09$, $p = 0.046$). However, only age of student employees ($\beta = -0.18$, $p = .036$) and number of semesters employed by Dining Services ($\beta = 0.27$, $p = 0.01$) had an independent influence on food safety knowledge. Surprisingly, food safety attitudes and training did not have a significant influence on food safety knowledge. The percentage of explained variance (R^2) for the model was very low (0.07).

The fourth model testing the contribution of student employees' food safety knowledge, practice, and training scores, and four demographic variables in explaining student employees' food safety attitudes was significant ($F = 9.00$, $p = 0.000$). Food safety practices ($\beta = 0.43$, $p = 0.000$), age of student employees ($\beta = 0.21$, $p = 0.009$), and number of semesters employed by Dining Services ($\beta = -0.22$, $p = 0.018$) had an independent influence on food safety attitudes. The percentage of explained variance (R^2) for the model was 0.23.

Four multiple linear regression models also were conducted to test relationships among full-time employees' total scores for food safety knowledge, attitudes, practices, training, and demographic variables. None of these models was significant.

Conclusions and Recommendations

The key finding for this research was that there were significant differences in food safety knowledge, attitudes, practices, and training between student and full-time employees in university foodservice. Furthermore, student employees' food safety attitudes and training had a

significant positive influence on food safety practices. Results showed that student employees lacked knowledge and training related to proper handwashing procedures, time and temperature control, cross contamination, and sanitizer concentration.

Recommendations for managers in college and university foodservice, based on results of this study, include:

- ◆ Use the instrument developed for this study to conduct a self-assessment of training needs related to food safety.
- ◆ Implement an efficient food safety training program for student employees in to ensure student employees have appropriate levels of food safety knowledge and positive attitudes, and demonstrate these in practice.
- ◆ Consider providing food safety training not only during student employee orientation, which usually is held at the beginning of the semester, but also in the middle of semester as a reminder to student employees.
- ◆ Develop a checklist to ensure all food safety components are covered during food safety orientation and training.
- ◆ Consider use of a food safety training program delivered by CD-ROM. That method is flexible, cost-effective, and easy to use; and it will ensure student employees receive a consistent message.

REFERENCES

- Cohen, E., Reichel, A., & Schwartz, Z. (2001). On the efficacy of an in-house food sanitation training program: Statistical measurements and practical conclusions. *Journal of Hospitality & Tourism Research*, 25 (1), 5-16.
- Cushman, J. W., Shanklin, C. W., & Niehoff, B. P. (2001). Hygiene practices of part-time student employees in a university foodservice operation. *The Journal of the National Association of College & University Food Services*. Retrieved June 20, 2003 from http://www.nacufs.org/resources/publications/journal_2001.pdf
- Fiihr, D. M. (2001). *Evaluation of a management model designed to increase retention of student employees in college and university dining service*. Unpublished master's thesis, Iowa State University, Ames.
- Henroid, D. Jr., & Sneed, J. (2004). Readiness to implement hazard analysis critical control point (HACCP) systems in Iowa schools. *Journal of the American Dietetic Association*, 104, 180-185.
- Hsu, C. H. C., & Huang, S. (1995). Sanitation knowledge, attitudes, and behaviors of food service workers in big ten universities. *The Journal of the National Association of College & University Food Services*. Retrieved November 26, 2002 from <http://www.nacufs.org/resources/publications/journal/old/sanitation.asp>
- Neumann, R., Stevens, A. N., & Graham, A. (2001). Student attitudes toward part-time employment while in college. *The Journal of the National Association of College & University Food Services*. 23, 45-50.

- Sneed, J., Strohbehn, C., & Gilmore, S. A. (2004). Food safety practices and readiness to implement hazard analysis critical control point (HACCP) programs in assisted-living facilities in Iowa. *Journal of the American Dietetic Association, 104*, 1678-1683.
- Unklesbay, N., Sneed, J., & Toma, R. (1998). College students' attitudes, practices, and knowledge of food safety. *Journal of Food Protection, 61*, 1175-1180.
- Wie, S.H., & Strohbehn, C. H. (1997). The impact of a sanitation food safety course on attitudes and knowledge of hospitality students. *Journal of Hospitality & Tourism Education, 9*, 65-73.